ATTACHMENT I

PROPOSED TECHNICAL SPECIFICATION CHANGES RELATED TO SCRAM DISCHARGE VOLUME SYSTEM MODIFICATIONS

New York Power Authority
James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
June 1983

3.1 BASES

The reactor protection system automatically initiates a reactor scram to:

1. Preserve the integrity of the fuel cladding.
2. Preserve the integrity of the Reactor Coolant System.
3. Minimize the energy which must be absorbed following a loss of coolant accident, and prevent inadvertent criticality.

This specification provides the limiting conditions for operation necessary to preserve the ability of the system to perform its intended function even during periods when instrument channels may be out of service because of maintenance. When necessary, one channel may be made inoperable for brief intervals to conduct required functional tests and calibrations.

The Reactor Protection System is of the dual channel type (Reference subsection 7.2 FSAR). The System is made up of two independent trip systems, each having two subchannels of tripping devices. Each subchannel has an input from at least one instrument channel which monitors a critical parameter.

The outputs of the subchannels are combined in a 1 out of 2 logic; i.e., an input signal on either one or both of the subchannels will cause a trip system trip. The outputs of the trip systems are arranged so that a trip on both systems is required to produce a reactor scram.

This system meets the intent of IEEE-279 (1971) for Nuclear Power Plant Protection Systems. The system has a reliability greater than that of a 2 out of 3 system and somewhat less than that of a 1 out of 2 system.

With the exception of the average power range monitor (APRM) channel the intermediate range monitor (IRM) channels, the scram discharge volume, the main steam isolation valve closure and the turbine stop valve closure, each subchannel has one instrument channel. When the minimum condition for operation on the number of operable instrument channels per untripped protection trip system is met or if it cannot be met and the affected protection trip system is placed in a tripped condition, the effectiveness of the protection system is preserved.

Three APRM instrument channels are provided for each protection trip system. APRM's A and E operate contacts in one subchannel and APRM's C and E operate contacts in the other

3.1 BASES (cont'd)

is discharged from the reactor by a scram can be accommodated in the discharge piping. Each scram discharge instrument volume accommodates in excess of 34 gallons of water and is the low point in the piping. No credit was taken for this volume in the design of the discharge piping as concerns the amount of water which must be accommodated during a scram.

During normal operation the discharge volume is empty; however, should it fill with water, the water discharged to the piping from the reactor could not be accommodated, which would result in slow scram times or partial control rod insertion. To preclude this occurrence, level detection instruments have been provided in each instrument volume which alarm and scram the reactor when the volume of water reaches 34.5 gallons. As indicated above, there is sufficient volume in the piping to accommodate the scram without impairment of the scram times or amount of insertion of the control rods. This function shuts the reactor down while sufficient volume remains to accommodate the discharged water and precludes the situation in which a scram would be required but not be able to perform its function adequately.

A Source Range Monitor (SRM) System is also provided to supply additional neutron level information during startup but has no scram functions (reference paragraph 7.5.4 FSAR).

Thus, the IRM and APRM are required in the refuel and startup/hot standby modes. In the power range the APRM System provides required protection (reference paragraph 7.5.7 FSAR). Thus the IRM System is not required in the run mode. The APRM's cover only the power range. The IRM's and APRM's provide adequate coverage in the startup and intermediate range.

The high reactor pressure, high drywell pressure, reactor low water level and scram discharge volume high level scrams are required for startup and run modes of plant operation. They are, therefore, required to be operational for these modes of reactor operation.

The requirement to have the scram functions indicated in Table 3.1-1 operable in the refuel mode assures that shifting to the refuel mode during reactor power operation does not diminish the protection provided by the Reactor Protection System.

Turbine stop valve closure occurs at 10 percent of valve closure. Below 217 psig turbine first stage pressure (30 percent of rated), the scram signal due to turbine stop valve closure is bypassed because the flux and pressure scrams are adequate to protect the reactor.

TABLE 3.1-1 (cont'd)

REACTOR PROTECTION SYSTEM (SCRAM) INSTRUMENTATION REQUIREMENT

Minimum No. of Operable Instrument Channels per Trip System (1)	Trip Function	Trip Level Setting	Modes in Which Function Must Be Operable			Total Number of Instrument Channels Provided by Design for Both Trip Systems	Action (1)
			Refuel (6)	Startup	Run		
2	APRM Downscale	≥2.5 indicated on scale (9)			X	6 Instrument Channels	A or B
2	High Reactor Pressure	≤1045 psig	X(8)	X	X	4 Instrument Channels	A
2	High Drywell Pressure	≤2.7 psig	X(7)	X(7)	X	4 Instrument Channels	A
2	Reactor Low Water Level	≥12.5 in. indicated level (≥177 in. above the top of active fuel)	X	X	X	4 Instrument Channels	A
3	High Water Level in Scram Discharge Volume	≤34.5 gallons per Instrument Volume	X(2)	X	X	8 Instrument Channels	A
2	Main Steam line High Radiation	≤3x normal full power background	X	X	X	4 Instrument Channels	A
4	Main Steam Line Isolation Valve Closure	≤10% valve closure	X(3)(5)	X(3)(5)	X(5)	8 Instrument Channels	A

Table 4.1-1

REACTOR PROTECTION SYSTEM (SCRAM) INSTRUMENT FUNCTIONAL TESTS
MINIMUM FUNCTIONAL TEST FREQUENCIES FOR SAFETY INSTRUMENT AND CONTROL CIRCUITS

Instrument Channel	Group	Functional Test	Minimum Frequency (3)
Mode Switch in Shutdown	A	Place Mode Switch in Shutdown	Each refueling outage.
Manual Scram	A	Trip Channel and Alarm	Every 3 months.
RPS Channel Test Switch	A	Trip Channel and Alarm	Every refueling outage or after channel maintenance.
IRM			
High Flux	C	Trip Channel and Alarm(4)	Once per week during refueling or startup and before each startup.
Inoperative	C	Trip Channel and Alarm(4)	Once per week during refueling or startup and before each startup.
APRM			
High Flux	B	Trip output Relays(4)	Once/week.
Inoperative	B	Trip output Relays(4)	Once/week
Downscale	B	Trip output Relays(4)	Once/week
Flow Bias	B	Calibrate Flow Bias Signal(4)	Once/month(1)
High Flux in Startup or Refuel	C	Trip Output Relays(4)	Once per week during refueling or startup and before each startup.
High Reactor Pressure	B	Trip Channel and Alarm(4)	Once/month.(1) (Instrument check once per day
High Drywell Pressure	A	Trip Channel and Alarm	Once/month(1)
Reactor Low Water Level (5)	A	Trip Channel and Alarm	Once/month(1)
High Water Level in Scram Discharge Instrument Volume	A	Trip Channel	Once/month(7)
High Water Level in Scram Discharge Instrument Volume	B	Trip Channel and Alarm	Once/month
Main Steam Line High Radiation	B	Trip Channel and Alarm(4)	Once/week.

Table 4.1-1 (cont'd)

REACTOR PROTECTION SYSTEM (SCRAM) INSTRUMENT FUNCTIONAL TESTS
MINIMUM FUNCTIONAL TEST FREQUENCIES FOR SAFETY INSTRUMENT AND CONTROL CIRCUITS

NOTES FOR TABLE 4.1-1 (cont'd)

5. The water level in the reactor vessel will be perturbed and the corresponding level indicator changes will be monitored. This perturbation test will be performed every month after completion of the functional test program.

6. Deleted.

7. The functional test shall be performed utilizing a water column or similar device to provide assurance that damage to a float or other portions of the float assembly will be detected.

Table 4.1-2

REACTOR PROTECTION SYSTEM (SCRAM) INSTRUMENT CALIBRATION
MINIMUM CALIBRATION FREQUENCIES FOR REACTOR PROTECTION INSTRUMENT CHANNELS

Instrument Channel	Group (1)	Calibration (4)	Minimum Frequency Once/week
IRM High Flux	C	Comparison to APRM on Controlled Shutdowns	Maximum frequency once/week
APRM High Flux			
Output Signal	B	Heat Balance	Daily
Flow Bias Signal	B	Internal Power and Flow Test with Standard Pressure Source	Every refueling outage
LPRM Signal	B	TIP System Traverse	Every 1000 effective full power hours
High Reactor Pressure	B	Standard Pressure Source	Once/operating cycle
High Drywell Pressure	A	Standard Pressure Source	Every 3 months
Reactor Low Water Level	A	Pressure Standard	Every 3 months
High Water Level in Scram Discharge Instrument Volume	A	Water Column, Note (6)	Once/operating cycle, Note(6)
High Water level in Scram Discharge Instrument Volume	B	Standard Pressure Source	Every 3 months
Main Steam Line Isolation Valve Closure	A	Note(5)	Note(5)
Main Steam Line High Radiation	B	Standard Current Source(3)	Every 3 months
Turbine Plant Stage Pressure Permissive	A	Standard Pressure Source	Every 6 months
Turbine Control Valve Past Closure Oil Pressure Trip	A	Standard Pressure Source	Once/operating cycle

TABLE 3.2-3

INSTRUMENTATION THAT INITIATES CONTROL ROD BLOCKS

Minimum no. of Operable Instrument Channels Per Trip System	Instrument	Trip Level Setting	Total Number of Instrument Channels Provided by Design for Both Channels	Action
2	APRM Upscale (Flow Biased)	$s \leq (0.66W+42\%) x \frac{FRP}{MFLPD}$	6 Inst. Channels	(1)
2	APRM Upscale (Start-up Mode)	≤12%	6 Inst. Channels	(1)
2	APRM Downscale	≥2.5 indicated on scale	6 Inst. Channels	(1)
1 (6)	Rod Block Monitor (Flow Biased)	S ≤0.66W+K (8)	2 Inst. Channels	(1)
1 (6)	Rod Block Monitor (Downscale)	≥2.5 indicated on scale	2 Inst. Channels	(1)
3	IRM Downscale (2)	≥2% of full scale	8 Inst. Channels	(1)
3	IRM Detector not in Start-up Position	(7)	8 Inst. Channels	(1)
3	IRM Upscale	≤86.4% of full scale	8 Inst. Channels	(1)
2 (4)	SRM Detector not in Start-up position	(3)	4 Inst. Channels	(1)
2 (4) (5)	SRM Upscale	$\leq 10^5$ counts/sec	4 Inst. Channels	(1)
1	Scram Discharge Instrument Volume High Water Level	≤26.0 gallons per instrument volume	2 Inst. Channels	(9) (10)

NOTES FOR TABLE 3.2-3

1. For the Start-up and Run positions of the Reactor Mode Selector Switch, there shall be two operable or tripped trip systems for each function. The SRM and IRM block need not be operable in run mode, and

INSTRUMENTATION THAT INITIATES CONTROL ROD BLOCKS

NOTES FOR TABLE 3.2-3

the APRM and RBM rod blocks need not be operable in start-up mode. From and after the time it is found that the first column cannot be met for one of the two trip systems, this condition may exist for up to seven days provided that during that time the operable system is functionally tested immediately and daily thereafter; if this condition lasts longer than seven days, the system shall be tripped. From and after the time it is found that the first column cannot be met for both trip systems, the systems shall be tripped.

2. IRM downscale is bypassed when it is on its lowest range.

3. This function is bypassed when the count rate is ≥ 100 cps.

4. One of the four SRM inputs may be bypassed.

5. This SRM Function is bypassed when the IRM range switches are on range 8 or above.

6. The trip is bypassed when the reactor power is ≤ 30%.

7. This function is bypassed when the Mode Switch is placed in Run.

8. S = Rod Block Monitor Setting in percent of initial.

   W = Loop recirculation flow in percent of rated

   K = Intercept values of 39% 40%, 41% and 42% can be used with appropriate MCPR limits from Section 3.1.B.

9. When the reactor is subcritical and the reactor water temperature is less than 212°F, the control rod block is required to be operable only if any control rod in a control cell containing fuel is not fully inserted.

10. When one of the instruments associated with scram discharge instrument volume high water rod blocks is not operable, the trip system shall be tripped.

b. The control rod directional control valves for inoperable control rods shall be disarmed electrically.

c. Control rods with scram times greater than those permitted by Specification 3.3.C.3 are inoperable, but if they can be inserted with control rod drive pressure they need not be disarmed electrically.

d. Control rods with a failed "Full-in" or "Full-out" position switch may be bypassed in the Rod Sequence Control System and considered operable if the actual rod position is known. These rods must be moved in.

e. When it is initially determined that a control rod is incapable of normal insertion, an attempt to fully insert the control rod shall be made. If the control rod cannot be fully inserted:

shutdown margin test shall be made to demonstrate under this condition that the core can be made subcritical for any reactivity condition during the remainder of the operating cycle with the analytically determined, highest worth control rod capable of withdrawal, fully withdrawn, and all other control rods capable of insertion fully inserted. If Specification 3.3.A.1 and 4.3.A.1 are met, reactor startup may proceed.

f. The scram discharge volume drain and vent valves shall each be full-travel cycled at least once per quarter to verify that the valves close in less than 30 seconds and to assure proper valve stroke and operation.

3.3 (cont'd)

2. The average of the scram insertion times for the three fastest operable control rods of all groups of four control rods in a two-by-two array shall be no greater than:

Control Rod Notch Position Observed	Average Scram Insertion Time (Sec.)
46	0.361
38	0.977
24	2.112
04	3.764

4.3 (cont'd)

2. At 8-week intervals, 15 percent of the operable control rod drives shall be scram timed above 950 psig. Whenever such scram time measurements are made, an evaluation shall be made to provide reasonable assurance that proper control rod drive performance is being maintained.

3. All control rods shall be determined operable once each operating cycle be demonstrating the scram discharge volume drain and vent valves operable when the scram test initiated by placing the mode switch in the SHUTDOWN position is performed as required by Table 4.1-1 and by verifying that the drain and vent valves:

   a. Close in less than 30 seconds after receipt of a signal for control rods to scram, and

   b. Open when the scram signal is reset or the scram discharge instrument volume trip is bypassed.

ATTACHMENT II

SAFETY EVALUATION RELATED TO SCRAM DISCHARGE VOLUME SYSTEM MODIFICATIONS

New York Power Authority
James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
June 1983

I. Description of the Changes

The proposed changes to the FitzPatrick Technical Specifications revise operating and surveillance limits associated with Scram Discharge Volume (SDV) system modifications. These modifications, described in Reference 1, are being made during the ongoing Reload 5/Cycle 6 refueling outage.

Specifically, the single Scram Discharge Instrument Volume will be replaced with two instrument volumes of equal size, each located near its respective scram discharge header. Hydraulic coupling between the discharge headers and instrument volumes will be improved by replacing the interconnecting 2-inch diameter pipe with a 10-inch diameter pipe from each header. Redundant drain and vent valves and level instruments will be provided for each instrument volume to meet the single failure criterion specified by the NRC.

Moreover, automatic scram (RPS) water level instrumentation in each instrument volume will consist of float switches and analog (differential pressure) transmitters for diversity. Level instrumentation taps will be taken from the instrument volumes rather than from connecting piping. Lastly, the instrumentation will be capable of detecting water in the instrument volumes prior to scram initiation. As a result of these modifications, the following Technical Specifications changes are being proposed.

1. In section 3.1 of the bases on page 32, the phrase, "scram discharge volume," is inserted in the third paragraph of the righthand column.

2. In section 3.1 of the bases on page 34, first paragraph, the sentence, "The scram discharge volume accomodates in excess of 36 gallons of water and is the low point in the piping," is changed to read, "Each scram discharge instrument volume accommodates in excess of 34 gallons of water and is the low point in the piping."

3. In section 3.1 of the bases on page 34, second paragraph, the sentence, "To preclude this occurrence, level switches have been provided in the instrument volume which alarm and scram the reactor when the volume of water reaches 36 gallons," is replaced by the sentence, "To preclude this occurrence, level detection instruments have been provided in each instrument volume which alarm and scram the reactor when the volume of water reaches 34.5 gallons."

4. In Table 3.1-1 on page 41a, the specifications for the "High Water Level in Scram Discharge Volume" trip function are changed. The minimum number of operable instrument channels per trip system is changed from 2 to 3. The trip level setting is changed from " $\leq$ 36 gallons" to " $\leq$ 34.5 gallons per instrument volume." And the number of instrument channels provided by design for both trip systems is changed from 4 to 8.

5. In Table 4.1-1 on page 44, the label, "Instrument Channel," is added to the lefthand column. In this column, an additional reference to "High Water Level in Scram Discharge Instrument Volume" is added. This added circuit is in Group B and has functional test requirements for the trip channel and the alarm of once each month. Also in this table, the "alarm" functional test for the Group A RPS circuit for High Water Level in

Scram Discharge Instrument Volume is deleted. Also for this circuit, the functional test requirement of "before each startup" is deleted, along with the reference to Note 6 accompanying this requirement.

6. In the notes for Table 4.1-1 on page 45a, Note 6 is deleted.

7. In Table 4.1-2 on page 46, an additional reference to "High Water Level in Scram Discharge Instrument Volume" is added to the column under the heading, "Instrument Channel." This added circuit is assigned to Group B and must be calibrated once every 3 months using a standard pressure source.

8. In Table 3.2-3 on page 72, the specifications for "Scram Discharge Instrument Volume High Water Level" are changed. The minimum number of operable instrument channels per trip system remains 1. The trip level setting, however, is changed from "$\leq$ 18 gallons" to "$\leq$ 26.0 gallons per instrument volume." The total number of instrument channels provided by design for both channels is changed from 1 to 2.

9. In the notes for Table 3.2-3 on page 73, Note 10 is replaced by the following: "When one of the instruments associated with scram discharge instrument volume high water level rod block is not operable, the trip system shall be tripped."

10. Section 4.3.A.2.f on page 89a is revised to read as follows: "The scram discharge volume drain and vent valves shall be full-travel cycled at least once per quarter to verify that the valves close in less than 30 seconds and to assure proper valve stroke and operation."

11. In section 4.3.C.3a on page 96, the specification for closure time of drain and vent valves is changed from 80 seconds to 30 seconds.

II. Purpose of the Changes

In June 1980, during a routine shutdown of the Browns Ferry Unit 3 reactor, a manual scram from 36 percent power failed to insert 40 percent of the reactor's control rods. Subsequent investigations revealed the cause of the problem to be an accumulation of water in the Scram Discharge Header, which reduced the available free volume for discharge water. While it was believed that the Scram Discharge Volume (SDV) water level instrumentation was designed to scram the reactor before water could accumulate in the header, the level instrumentation at Browns Ferry did not detect the water.

As a result of this event and the discovery of other SDV system deficiencies at BWR sites around the country, a BWR Owners' Group was formed in conjunction with an NRC task force to develop revised design, safety, operational and performance criteria for long-term modifications of the SDV system. The requirements of IE Bulletins 80-14 (Ref. 2) and 80-17 (Ref. 3), with supplements, provided a technical basis for interim operation until the long-term modifications could be completed.

The various criteria developed by the Owners' Group, as supplemented by additional NRC requirements for diversity of instrumentation, formed the basis for the permanent, long-term modifications of the FitzPatrick SDV system described in Section I and in Reference 1. These criteria were formally specified in the NRC's Generic Safety Evaluation Report (SER), "BWR Scram

Discharge System," dated December 1, 1980 and amended by Generic Letter 81-18, dated March 30, 1981.

The principal design deficiencies identified by the SER were:

1) Inadequate hydraulic coupling between the Scram Discharge Header and the Instrument Volume.

2) A complex connection of piping to the vent and drain of the SDV system that could compromise their intended functions.

3) Common-cause failure mechanisms for the Instrument Volume water level switches.

4) The possibility that control air system failure, compounded by inadequate hydraulic coupling, could cause the inability to scram the reactor.

The modifications of the FitzPatrick SDV system being undertaken during the Reload 5/Cycle 6 outage will resolve all the above deficiencies in a manner defined as "Acceptable Compliance" in the SER (for a detailed analysis, see Attachment III). Hence, interim modifications required by Bulletins 80-14 and 80-17, as enforced by NRC Orders of October 1980 (Ref. 4) and January 1981 (Ref. 5) are being removed concurrent with the installation of the long-term SDV modifications. The first Order required continuous water level monitoring instrumentation, while the second required automatic scram on low air pressure in the control air header. The planned removal of these modifications was described in Reference 1.

As modified, the SDV system provides a controlled, near-atmospheric volume for the accumulation of scram discharge water which is released from each control rod Hydraulic Control Unit (HCU) upon initiation of a reactor scram.

There are 69 HCU's on the east side of the Reactor Building and 68 HCU's on the west side. The near-atmospheric volume available for scram located in the SDV above and near each bank of HCU's provides 3.34 gallons per HCU during the worst-case fast-fill event (when each HCU scram outlet valve leaks 6.4 gpm into the associated Scram Discharge Header and the associated vent and drain valves are closed).

Each Instrument Volume (east and west) has four scram level instruments (RPS channels A1, B1, A2 and B2) individually connected via one-inch diameter lines and root valves. Two of these instruments are float-operated level switches and two are differential pressure transmitters. The scram level specified in the proposed Technical Specifications (accumulation of 34.5 gallons in the 24-inch diameter Instrument Volume) has been determined utilizing results from open-channel flow analysis and RPS system time delay in scram outlet valve actuation. Thus, adequate volume for scram, under the worst conditions, remains in the modified system. The setpoints for the diverse instruments were determined based on qualified parameters such as accuracy and reset.

The modified SDV system functions in either of two situations:

1) A reactor scram actuated by water level sensing trip switches/trip units connected to the Instrument Volumes, based on attainment of a high water level.

2) A reactor scram initiated by RPS sensors outside of the SDV system.

The attainment of a high water level in the Instrument Volume sufficient to actuate an instrument in both the A and B trip systems will cause the respective RPS trip system to be de-energized; thus causing the respective SOV-31 air control valve to change position. With both RPS trip systems tripped, SOV-31A and 31B will, in concert, cause the air, which holds the vent and drain valves open, to be dumped. This action closes the vent and drain valves on both Instrument Volumes within a time interval not to exceed 30 seconds. Concurrent with the de-energization of SOV-31A & 31B, the individual HCU scram solenoids are also de-energized, causing the scram outlet valves to open and exhaust the scram discharge water to the associated Scram Discharge Header. With the continued passing of water past the scram outlet valve and to the Scram Discharge Header, the entire SDV system is pressurized to reactor pressure.

The System is emptied (upon clearing of the condition causing the scram) by actuation of the Discharge Volume Level Trip Bypass and Reset switch, located on the main control board, while the Mode Selector Switch is in "Refuel" or "Shutdown". With this action, the RPS circuits are re-energized and the air-operated valves (vents and drains on both East and West sides) opened, allowing the accumulated water to drain to the associated Reactor Building equipment drain sumps.

When the Instrument Volume water level has dropped sufficiently to allow the re-establishment of the scram level instrument circuits, the bypass switch can be returned to its standard position and the reactor moved into a mode other than Refuel or Shutdown, as required. The function of the vent and drain valves can also be ascertained via the SOV-29 test solenoid switch located on the Main Control Panel. The initial presence of water in the Instrument Volumes is annunciated to the control room and to the plant computer via non-safety related slave trip units. The defined water accumulation point for this alarm is 17.45 gallons. A further level increase above the alarm point will actuate a rod block. The defined rod block water accumulation level is 26.0 gallons.

The proposed Technical Specification changes described in Section I and in Attachment I are designed to accompany the above long-term SDV system modifications and to meet the surveillance criteria of the NRC's Generic SER.

Specifically, the proposed change on Page 32 is required to include the Scram Discharge Volume in the list of instrumentation systems having more than one instrument channel in each tripping device subchannel per RPS trip system.

The changes on Page 34 are required because the Scram Discharge Volume system has been modified to have one Instrument Volume per Scram Discharge Header, each capable of accomodating in excess of 34 gallons and each provided with diverse level instrumentation.

The changes on Page 41a reflect changes in the SDV high water level instrumentation, which, as modified, requires a minimum of 3 operable channels per trip system. The total number of instrument channels provided by design per trip system is 4, each containing 2 float switches and 2 differential pressure-actuated switches per trip system, for a total of 8 operable channels containing 4 float switches and 4 differential pressure-actuated switches per trip system. The objective of these changes is to guarantee redundancy and diversity in the Instrument

Volume Level instrumentation. Signals from these instruments are arranged in a one-out-of-two-taken-twice logic for the Reactor Protection System. Float level switches and analog type (differential pressure) switches on each Instrument Volume in each channel are combined in a logic "OR" gate such that a single failure of one switch will not prevent actuation of the associated protective channel.

A common mode failure of all level instruments of the same type will not result in the inability to provide a full scram actuation signal. The redundant instrumentation is powered from separate and redundant vital 115 volt A-C electrical busses. Loss of power in one bus will de-energize the trip relays on that bus and cause a half-scram signal actuation. The trip level setting for scram initiation is 34.5 gallons per Instrument Volume.

Because the instrument referred to by Note 6 on page 45a is functionally tested each month, the additional testing requirement of "before each startup" is deleted in Table 4.1-1 on page 44, along with Note 6.

The changes on pages 44 and 46 provide specifications for functional testing for the two RPS circuits for High Water Level in Scram Discharge Instrument Volume. These changes prescribe monthly trip channel functional tests of RPS channel A level instruments (float switches) and require that channel calibration be performed once per operating cycle using a water column. Trip channel and alarm functional tests of RPS channel B level instruments (differential pressure-actuated switches) must be performed monthly, and channel calibration must be performed every three months using a standard pressure source.

The change on Page 72 prescribes a minimum of 1 operable instrument channel per rod block trip system to initiate a control rod block at Instrument Volume high water level. The FitzPatrick SDV system, however, has 2 instrument channels provided by design for both trip systems, as well as 4 float switches and 4 differential pressure-actuated switches with settings at three different water levels. These settings guard against operation of the reactor without sufficient free volume in the scram discharge headers to accept scram discharge water in the event of a scram. The signals for the first two levels (alarm and rod block) are received from either one of two slave trip units which are activated by their respective analog (differential pressure) transmitters on the attainment of the high level alarm set point or rod block set point. The setting for rod block is 26.0 gallons per Instrument Volume. The highest level setpoint, to initiate a reactor scram, is 34.5 gallons per Instrument Volume. At this setting, the eight level switches (4 for each RPS trip system) initiate a scram to shut down the reactor while sufficient volume remains to receive the scram discharge water.

As required by Design Criterion 9 in the Generic SER, instrumentation has been provided to aid the operator in the detection of water accumulation in the Instrument Volume prior to scram initiation.

The change on page 73 modifies Note 10 of Table 3.2-3 to require that the trip system be tripped if all the instruments associated with scram discharge instrument volume high water level are not operable.

The changes on Pages 89a and 96 are required to comply with Surveillance Criterion 1 of the Generic SER, which states, as part of its Technical Basis, that "Periodic testing of the vent and drain valves will verify acceptable opening and closing times and assure proper valve stroke and operation." As part of its Acceptable Compliance section, this criterion further states that "This testing should show valve closure in less than 30 seconds."

The surveillance criteria of the Generic SER are:

1) "Vent and drain valves shall be periodically tested."

2) "Verifying and level detection instrumentation shall be periodically tested in place."

3) "The operability of the entire SDV system as an integrated whole shall be demonstrated periodically and during each operating cycle, by demonstrating scram instrument response and valve function at pressure and temperature at approximately 50 percent control rod density."

Surveillance Criteria 1 and 2 are addressed in the existing Technical Specification surveillance requirements as amended by this proposed change.

A integrated system test will be performed during start-up from the current refueling outage (June - August 1983). This test will verify operability of the entire system by demonstrating scram instrument volume response and valve function. This test will be performed at operating temperature and pressure with a control-rod density of approximately fifty percent.

Section 4.3.C (Scram Insertion Times) of the FitzPatrick Technical Specifications already require extensive surveillance testing of the control rod drive system on a periodic basis.

Therefore, no additional surveillance requirements are proposed to comply with Criterion 3.

III. Impact of the Changes

The modifications of the FitzPatrick SDV System and the accompanying proposed Technical Specifications changes will have a positive impact on plant safety. Because the modified SDV system resolves NRC concerns associated with inadequate hydraulic coupling, lack of redundancy and diversity of instrumentation, and common cause failure mechanisms, the modified system improves the safety of the reactor. The proposed Technical Specification changes reflect the modified design of the SDV system and meet the operational and surveillance requirements of the NRC's Generic SER. The operating, design and surveillance criteria upon which the proposed changes are based were formulated by the NRC as a means of ensuring acceptable, long-term operation. As outlined in Attachment III, the FitzPatrick station is satisfying all of these criteria in an acceptable manner. Interim operating requirements, imposed by the Orders of References 4 and 5 until the long-term measures described above could be implemented, are being rescinded in view of demonstration of acceptable operation incorporating the long-term modification.

The Authority considers that this proposed amendment can be classified as not likely to involve significant hazards considerations because it "involves relief granted upon demonstration of acceptable operation from an operating restriction that was imposed because acceptable operation was not yet demonstrated." (Example (iv), Federal Register, Vol. 48 No. 67 dated April 6, 1983, page 14870). Restrictions were applied on the operation of the FitzPatrick plant by the NRC in the form of two orders (References 4 and 5). The approval criteria have been established by the NRC in their Generic Safety Evaluation Report "Bwr Scram Discharge System" dated December 1, 1980 as amended by Generic Letter No. 81-18 dated March 30, 1981. Attachment No. III ("Conformance of Scram Discharge Volume System to the Criteria of NRC Generic Safety Evaluation Report") describes how this criteria has been met.

Thus, the proposed Technical Specification changes involve no Significant Hazards Considerations, as defined in 10 CFR 50.92.

IV. Implementation of the Changes

Implementation of the changes, as proposed, will not impact the fire protection program at FitzPatrick; nor will the changes impact the environment. The Authority has conducted an analysis designed to ensure that personnel doses from implementation of the SDV system modifications are kept As Low As is Reasonably Achievable. Nevertheless, significant personnel doses are expected to result from installation of the modifications. Because the Technical Specifications changes themselves specify, in most cases, remote surveillance of the modified SDV system, long-term radiation exposure is expected to decrease as a result of the changes.

V. Conclusion

The incorporation of these changes: a) will not increase the probability or the consequences of an accident or malfunction of equipment important to safety as evaluated previously in the Safety Analysis Report; b) will not increase the possibility of an accident or malfunction of a type other than that evaluated previously in the Safety Analysis Report; c) will not reduce the margin of safety as defined in the basis for any Technical Specification; d) does not constitute an unreviewed safety question, and e) involves no Significant Hazards Considerations, as defined in 10 CFR 50.92.

VI. References

1) PASNY letter, J. P. Bayne to H. R. Denton and R. DeYoung, May 12, 1983 (JPN-83-41).

2) NRC IE Bulletin 80-14, June 13, 1980.

3) NRC IE Bulletin 80-17, July 3, 1980, with Supplements 1 (July 18, 1980), 2 (July 22, 1980), 3 (August 22, 1980) and 4 (December 18, 1980).

4) NRC Confirmatory Order, V. Stello to G. T. Berry, October 2, 1980.

5) NRC Order for Modification of License, T. A. Ippolito to G. T. Berry, January 9, 1981.

ATTACHMENT III

CONFORMANCE OF SCRAM DISCHARGE
VOLUME SYSTEM TO THE CRITERIA
OF NRC GENERIC SAFETY EVALUATION REPORT

New York Power Authority
James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
June 1983

FitzPatrick Scram Discharge Volume System

Compliance With NRC Generic Safety Evaluation

The functional, safety, operating and design criteria listed below are extracted from the NRC Generic Safety Evaluation Report (and Generic Letter 81-18).

1. Functional Criterion No. 1 - "The scram discharge volume shall have sufficient capacity to receive and contain water exhausted by a full reactor scram without adversely affecting control rod drive scram performance."

The capacity of the SDV (8" Ø headers, 10" Ø connecting line and 24" Ø instrument volume) has been provided so as to assure a free volume of 3.34 gallons per Hydraulic Control Unit (HCU) at the worst case maximum inflow leakage past the scram valves.

In regard to the operation under degraded conditions, this project has addressed the occurrence of low air pressure in the CRD control air headers. Operation under degraded control air conditions could result in a SDIV "fast fill" event. The hydraulic design incorporated in this long term modification addresses this "worst case" situation and by the following quote from the NRC SER eliminates the need for the CRD Control Air System Modification (F1-81-01) presently installed:

> "In the long term, the improved hydraulic coupling will assure detection by level instrumentation and thereby provide a timely automatic scram independent of the inleakage rate when the SDV headers fill." (p. 29 of NRC SER)

2. Safety Criterion No. 1 - "No single failure of a component or service function shall prevent a reactor scram, under the most degraded conditions that are operationally acceptable."

NRC RG 1.53 requires that no credible single failure result in the inability of a protective system to perform its intended safety related function. The Scram Discharge Instrument Volume (SDIV) electrical power and control and instrumentation is designed on a redundant basis. All wiring, conduit and cable/raceway runs are physically separated to prevent a single physical or electrical failure from isolating the SDIV on a reactor scram or on a high level signal in the SDIV. Redundant control air lines are routed from the SDIV air dump solenoid valves (SOV 31A & B) to the redundant vent and drain isolation valves The SDIV level measuring instruments are provided with redundancy and diversity as described under Safety Criterion No. 3.

3. Safety Criterion No. 2 - "No single active failure shall prevent uncontrolled loss of reactor coolant."

The criterion establishes the design basis for preventing loss of reactor coolant due to a single failure in the SDIV System. It further states that an acceptable way of meeting this criterion is to install two isolation valves in series for the vent and drain function.

Two isolation valves are installed in series for the vent and drain functions to prevent a single failure of a valve from preventing the isolation of the vent or drain. An uncontrolled loss of reactor coolant due to single isolation valve failure-to-close is thus prevented.

Two control air lines are routed from the scram solenoid valves to the redundant vent and drain isolation valves. A single failure in one control air line will not prevent the other control air line from closing the redundant isolation valves. The 115 volt a-c scram solenoid valves are backed up by 125 volt d-c solenoid valves powered from the station battery. A single failure of one of the 115 volt a-c solenoid valves will not, therefore, prevent the isolation valves from closing.

4. Safety Criterion No. 3 - "The scram discharge system instrumentation shall be designed to provide redundancy, to operate reliably under all conditions, and shall not be adversely affected by hydrodynamic forces or flow characteristics."

Each SDIV is provided with level measuring instrumentation which meets the requirement for redundancy and diversity. Each SDIV has two float type level switches and two differential pressure type level instruments for actuating a scram on high SDIV level. Float switches and differential pressure actuated switches are arranged electrically in an "or" gate logic so that a failure of one type of measurement due to a common mode failure will not result in the inability to initiate a reactor scram on high SDIV level. The level switches are arranged in a one-out of two taken twice logic arrangement. Therefore, the instrumentation on each SDIV meets the single failure criterion.

The Hydraulic Transient Analysis was made to determine the possible impact of hydrodynamic forces in the system. The effect of the hydrodynamic forces has been incorporated into the design of the two (2) types of instrumentation used in this design. In addition, the impact of flow characteristics has been determined and incorporated into the specification of the instrumentation which may be flow sensitive, i.e., the float-operated level switch.

The level sensors provided for each Trip System are of two (2) diverse types. The float operated level switch (class 1E qualified) is similar in operation and construction to that which is presently in use. The second type of level sensor is a sealed sensor system with a differential pressure transmitter which has operating principals totally different from that employed by the float-operated level switch. This diverse instrumentation is completely class 1E qualified and provides assurance of protection from common cause failures due to float-crushing, etc. Also, the possibility of a common cause failure is further protected against by: 1) the periodic functional testing of level instrumentation as required by Surveillance Criteria 2 of the NRC SER, 2) the operational principal diversity, and 3) the qualification of instruments to IEEE 323 and 344.

The redundant instrumentation is powered from separate and redundant vital 115 VAC electrical busses such that a loss of electrical power in one bus will not cause an unnecessary scram. The electrical system is arranged so that Bus "A" powers the "A" system instruments and relays and Bus "B" powers the "B" system instruments and relays. A failure of either of these busses will cause a half scram.

5. <u>Safety Criterion No. 4 - "System operating conditions which are required for scram shall be continuously monitored."</u>

The SDIV is measured by redundant and diverse level instrumentation as described in section 4 above.

In addition, the control room operator is provided with the following annunciators, computer printouts and status indicating lights.

1) <u>Annunciator Inputs</u>

- One common annunciator window for "HIGH LEVEL SDIV SCRAM" on any one of 8 scram level instruments - 4 float switches and 4 differential pressure actuated switches.

- One annunciator window to indicate "SDIV NOT DRAINED". This window is activated from either one of two slave trip units which are activated by their respective differential pressure transmitters on the attainment of the high level alarm point. There is one alarm function associated with each of the SDIVs.

- One annunciator window to indicate "HIGH SDIV TRIP BYPASSED" if bypass is selected in shutdown or refueling mode.

2) Computer Inputs

- One computer input for each of 8 level instruments - 4 float switches and 4 differential pressure actuated switches. Indication is "Hi level SDV trip".

- Two computer inputs to indicate "Rod Block Withdrawal". (One at each SDIV)

- Two computer inputs to indicate water level at "Alarm" condition. (One at each SDIV)

3) Status Indicating Lights

- One indicating light for "OPEN" and one for "CLOSED" from each SDIV vent and drain valve. Open = Red, Closed = Green. A total of 16 lights is provided, 2 from each of 8 valves.

6. Safety Criterion No. 5 - "Repair, replacement, adjustment, or surveillance of any system component shall not require the scram function to be bypassed."

When a level device is removed from service, the device will be bypassed. Float level switches and analog type (differential pressure) switches on each Instrument Volume in each channel are combined in a logic "OR" gate such that bypassing any one switch will not prevent actuation of the associated protective channel.

7. Operational Criteria No. 1 to 5

(1) "Level instrumentation shall be designed to be maintained, tested, or calibrated during plant operation without causing a scram."

(2) "The system shall include sufficient supervisory instrumentation and alarms to permit surveillance of system operation."

(3) "The system shall be designed to minimize the exposure of operating personnel to radiation."

(4) "Vent paths shall be provided to assure adequate drainage in preparation for scram reset."

(5) "Vent and drain functions shall not be adversely affected by other system interfaces. The objective of this requirement is to preclude water backup in the scram instrument volume which could cause spurious scram."

7.1. The level instrumentation is designed to be maintained, tested or calibrated during plant operation without scram as discussed in paragraph 6. Each instrument can be tested locally with proper function of respective relays, alarms and computer messages assuring full operational readiness.

7.2. Level instrumentation is provided with control room annunciator alarms and computer printouts to permit control room surveillance by the operator. Refer to Paragraph 5 for details of annunciators computer inputs and valve position indication lights.

7.3. The piping system is designed to minimize operating personnel exposure to radiation hazards. To assure minimal exposure of operating personnel to radiation hazards, the IV will be designed to accept temporary shielding and the vent line design will incorporate a protected, non-submerged discharge. In addition, hydrolase connections are provided at critical areas of the drain and SDV headers to permit clean out. Further, the IV and the drain line are provided with concrete block shielding enclosures.

7.4. The vent path provides adequate drainage at reset. The piping design task will assure adequate venting. There will be a one (1) inch diameter common vent from both the SDV header and the instrument volume.

7.5. Vent and drains will not be impacted by other system interfaces. The drains (2" dia) will be routed independently to equipment drain headers (4" dia) which, in turn, travel to the lower elevation equipment drain sumps to ensure highly reliable drainage. Since no increase in drain flow is expected and, in fact, is split now to two (2) 4" dia. drain headers, there is no impact on plant drainage systems.

The vents are provided with non-submerged discharge via a water knock-down chamber in the protected environment of nearby RHR heat exchanger rooms. This vent discharge arrangement is presently in operation at JAF and there are no operational problems regarding it.

8. Design Criterion No.1 - "The scram discharge headers shall be sized in accordance with G.E. OER-54 and shall be hydraulically coupled to the instrumented volumes in a manner to permit operability of the scram level instrumentation prior to loss of system function. Each system shall be analyzed based on a plant-specific maximum inleakage to ensure that the system function is not lost prior to initiation of automatic scram. Maximum inleakage is the maximum flow rate through the scram discharge line without control-rod motion summed over all control rods. The analysis should show no need for vents or drains."

The scram discharge volume (headers, connection from header to instrument volume and available portions of the instrument volume) are sized per G.E. OER 54 for 3.34 gal. per HCU coincident with the worst case in-flow rate determined from an open-channel hydraulic analysis. The headers are 8 inch diameter along the legs of the "U" and are 10 inch diameter at the cross piece of the "U". A 10 inch diameter pipe connects each of the headers with its respective instrument volume. The instrument volumes are 24 inches in diameter.

The worst case in-flow rate of 6.4 gpm per rod was determined from stall-flow tests conducted at JAFNPP. The open channel analysis utilized this value for inleakage rate summed over all the control rods connected to a header. Vent and drain flows are not necessary to assure system function.

9. Design Criterion No.2 - "Level instrumentation shall be provided for automatic scram initiation while sufficient volume exists in the scram discharge volume."

The hydraulic design and analysis task has established the scram discharge instrument volume required to meet the worst case volume requirements. The Instrument Arrangement Design and Analysis Procedure has established the instrument settings required to assure that automatic scram initiation will occur with sufficient margin to assure that an adequate scram discharge volume is present. Items included in the analysis of this criteria are:

1. Accuracy of float and differential pressure sensors
2. Level sensor time delay
3. Time delay from level sensor operation to trip of scram solenoids
4. Time delay in scram solenoid operation
5. Time delay in actuation of scram outlet valves on the HCU
6. Maximum rod seal leakage rates into scram discharge header during plant operation.

10. Design Criterion No.3 - "Instrumentation taps shall be provided on the vertical instrument volume and not on the connected piping."

The design provides two (2) separate taps directly to the instrument volume for each level instrument.

11. Design Criterion No.4 - "The scram instrumentation shall be capable of detecting water accumulation in the instrumented volume(s) assuming a single active failure in the instrumentation system or the plugging of an instrument line."

Single failure of level instrumentation is addressed in section 2.

All instrument taps are connected directly to the Scram Discharge Instrument Volume. This reduces or eliminates the possible accumulation of sediment which could plug the instrument sensing lines. Functional testing of the instrumentation of each SDIV in accordance with the technical specifications provides an additional level of assurance that plugging of the sensing lines will not occur.

The sensing line instrument isolation valve taps are located on the SDIV at different orientation to prevent a single plugging incident from disabling all instruments. The analog differential pressure transmitter is provided with sensing taps completely independent from the float level switches. Additionally, the differential pressure type instruments have a filled capillary sensing system which prevents sediment from reaching the instrument sensing mechanism.

12. Design Criterion No.5 - "Structural and component design shall consider loads and conditions including those due to fluid dynamics, thermal expansion, internal pressure, seismic consideration and adverse environment."

The piping, pipe supports, instrument volume/supports, instruments, conduit and block wall enclosures have considered loads due to fluid dynamics, thermal expansion, internal pressure, seismic consideration and adverse environment, as required.

13. Design Criterion No.6 - "The power-operated vent and drain valves shall close under loss of air and/or electric power. Valve position indication shall be provided in the control room."

All air operated SDIV vent and drain valves are of the air to open/fail close type. A loss of control air, control air tubing break or loss of both channels of vital 115 VAC which operate solenoids SV-31A & B will result in automatic spring-assisted closure of the air operated valves.

Each air operated vent and drain isolation valve is provided with a green and red indicating light on the main control panel to indicate closed and open position, respectively. At intermediate positions of the valve, both lights will be illuminated.

14. Design Criterion No.7 - "Any reductions in the system piping flow path shall be analyzed to assure system reliability and operability under all modes of operation."

    No reduction in flow area occurs in the SDV headers or SDV header to I.V. piping.

15. Design Criterion No.8 - "System piping geometry (i.e., pitch, line size, orientation) shall be such that the system drains continuously during normal plant operation."

    The piping for the SDV headers, the SDV header to I.V. piping, the drain and the vent piping are all sloped at least 1/8 inch per foot thus providing for continuous free draining of the SDS.

16. Design Criterion No.9 - "Instrumentation shall be provided to aid the operator in the detection of water accumulation in the instrument volume prior to scram initiation."

    Annunciators and computer printouts are provided for the operator to determine the occurrence of water accumulation in the SDIV prior to scram initiation. Refer to section 5 for details.

    This design criteria permits the present alarm and rod block withdrawal alarm to meet the requirements for surveillance provided that an acceptable hydraulic coupling exists. The hydraulic coupling of the scram discharge volume and the IV has been addressed in the hydraulic analysis task.

17. Design Criterion No.10 - "Vent and drain line valves shall be provided to contain the scram discharge water, with a single active failure and to minimize operational exposure."

    Each drain and vent line is provided with two (2) isolation valves in series and completely independent in operation. The redundancy provided in the valve control air system by the DC solenoids (SOV-140 & 141) provide acceptance to single failure criteria. The reliability of the well proven system will mitigate operational exposure.

18. Surveillance Criterion No. 1 - "Vent and drain valves shall be periodically tested."

    A Surveillance and Test Procedure will cover the periodic testing of the vent and drain valves via the SOV-29 switch which is located on the Main Control Panel. This test will record opening and closing times. Valve closure will be verified to be less than 30 seconds.

19. Surveillance Criterion No. 2 - "Verifying and level detection instrumentation shall be periodically tested in place."

    Surveillance and Test Procedure No. F-ISP-66 (Scram Discharge Volume High Water Level Instrument Functional Test/Calibration) will be updated to require draining of the instrument via the IV connection following operability testing of each instrument. In addition, operating procedures will be updated to require comparison of the Scram Discharge System drain rate with previous measurements subsequent to scram reset.

20. Surveillance Criterion No. 3 - "The operability of the entire system as an integrated whole shall be demonstrated periodically and during each operating cycle, by demonstrating scram instrument response and valve function at pressure and temperature at approximately 50% control-rod density."

    A integrated system test will be performed during start-up from the current refueling outage (June - August 1983). This test will verify operability of the entire system by demonstrating scram instrument volume response and valve function. This test will be performed at operating temperature and pressure with a control-rod density of approximately fifty percent.

Section 4.3.C (Scram Insertion Times) of the FitzPatrick Technical Specifications already require extensive surveillance testing of the control rod drive system on a periodic basis.